ABSTRACT

Over the past four decades Taiwan has experienced tremendous economic growth. Much of the debate surrounding Taiwan's success has focused on its trade policies and the relationship between export-orientation and high output growth. It has been shown in previous studies that export-oriented firms tend on average to be larger and have higher output than domestic-oriented firms. However, what is the reason behind the output differences between exporters and non-exporters? Is it because exporters are larger and employ more inputs, or given equal inputs are exporters more productive than domestic-oriented firms? This paper develops a model to distinguish the roles of resource-level differences from productivity differences in explaining output differences between exporters and non-exporters.

Our results indicate that the larger size of exporters relative to non-exporters explains the bulk of the difference in output between the two groups of producers. Nevertheless, we found that there are significant differences in productivity levels between exporters and non-exporters in eight of the twelve products examined. The contribution of these differences to the output differences between the producer groups varies from 3-18%. Furthermore, the magnitude of the contribution is product specific.

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TABLE OF CONTENTS

I. INTRODUCTION

Over the last four decades Taiwan's remarkable economic development and the success of its export-oriented economy have led many to refer to it as an "economic miracle." During this period Taiwan experienced rapid economic growth. Between 1953 and 1987, the average annual growth rate of real gross national product (GNP) was 8.8%, far greater than most developing and industrialized countries (U.S. - 2.7%, West Germany - 3.3%). Since 1984 Taiwan's economy has grown at an annual rate of 9.6%. In 1987 alone Taiwan's economy grew at an astonishing 11%. The majority of debate surrounding this "economic miracle" has focused on Taiwan's trade policies and the relationship between export-orientation and higher output growth.

In the early 1960's, Taiwan moved away from its previous policy of import substitution to a policy of promoting exports to stimulate industrialization. At approximately the same time as the change in trade policy, Taiwan began experiencing high levels of output growth. Taiwan's export-oriented policy and high growth can be partially explained by the fact that export-oriented firms on average tend to be larger (in terms of total sales and employment) and have higher output levels than it's non-exporters. Under the new trade policy, firms were given

incentives to become more export-oriented and those firms that changed their outlook began to expand. The consequent larger output of these growing export firms contributed greatly to the increase in Taiwan's output growth.

It is often debated that countries that pursue such export-oriented trade policies usually outperform those that favor import-substitution. The fact that export-orientation is associated with larger output growth has been well-documented in previous studies (Balassa 1978, 1981). In more recent work the focus has been on the link between productivity and market orientation. The mechanism that explains this link between export-orientation and productivity is that international markets are more competitive and as a result, exporting firms are given less leeway for inefficient operation. This explanation stresses firm characteristics, yet the majority of work on the topic has thus far been at the aggregate industry or country level.

This study uses firm-level information to determine the reason behind firm output differences based on market orientation. Are the output differences due to input level differences, or are they due to exporters having a higher level of productivity? This paper addresses this question by testing a model to distinguish firm input level

differences from productivity differences to explain output differences between exporters and non-exporters in 4 large Taiwanese industries.

The motivation and technique used in this paper are taken from Aw and Hwang (1995). In their study they apply their technique to a 1986 electronics data set, while this paper applies it to a broader, more current 1991 data set for Taiwan. Aw and Hwang studied the electronics industry in 1986 while this paper examines the electronics, textiles, apparel, and plastics industries in 1991. These four industries were chosen because collectively they account for a significant portion of Taiwan's total output. The more current data is used to determine whether export-oriented firm's larger output is due to higher input levels or from exporters having higher productivity than non-exporters. Since the electronics industry was studied in 1986 and 1991, the results from Aw and Hwang can be compared to those in this paper. Unfortunately the other three industries were not previously studied and have no prior results for comparison.

Aw and Hwang (1995) cite three sources of variation that could account for differences in output between firms that primarily export and those that do not. First, exporters could have better access to inputs such as

subsidized capital or imported machinery than non-exporters. Berry (1992) shows that the largest firms in an industry tend to do most of the exporting. This seems to support the fact that the differences in output observed between exporters and non-exporters could be due to input level differences. Exporters and non-exporters will have an output gap if exporters are generally larger (in terms of employment and output sales).

Second, exporters could be more productive given equal inputs due to factors associated with being in the export business, such as better access to foreign technology or greater competitive pressure in the international market. This explanation underscores the importance of firm heterogeneity in the analysis. If productivity analysis were done at an aggregate level, the differences between exporters and non-exporters would be lost. However, this paper is built on a Census-based firm-level microdata set for Taiwanese industries provided by Dr. Bee-Yan Roberts. Aw and Hwang perform a similar analysis on a 1986 data set for the electronics industry. As mentioned earlier, this paper uses a more current 1991 data set for a broader examination of four large manufacturing industries (electronics, plastics, apparel, textiles). The firm-level information makes it possible to analyze exporters and non-

exporters separately. This reduces the effects of macroeconomic factors, such as inflation or exchange rates that often make cross-country comparisons of export-orientation more difficult.

In this paper, we estimate separate production functions for the two groups in each industry, one for firms that were primarily exporters, and another for non-exporters. From these estimations, we determine if the output differences were due to the different levels of inputs used by exporters and non-exporters. In addition, the effects of productivity differences in the usage of the inputs are also examined.

Lastly, output differences between exporters and non-exporters could arise from exporters being in particular industries or products. Holding inputs and productivity constant, exporters could be concentrated in a product category that has higher output than the other product codes in that industry. If this were the case, then the output differences between exporters and non-exporters would be due to product differences. This paper addresses this source of output variation by examining individual industries separately. An analysis of the product composition of exporters and non-exporters by industry can reveal whether differences in product mix are a possible source of the

output variations. Because we are controlling for differences in product mix, the focus of the paper is on the first two sources of variation, input and productivity differences.

Section II will discuss Taiwan's overall economy to provide the general background for the four industries (electronics, plastics, apparel, and textiles) examined. In addition, Section II will also provide summary statistics of firm characteristics according to market orientation. Section III describes the empirical model used to estimate the production functions. It also describes the method used to distinguish between productivity and input level differences. Section IV describes the data and the process used to filter it. Section V contains the empirical results and Section VI is the conclusion. Section VII lists the references and Section VIII presents Appendix A.

II. MODERN ECONOMIC DEVELOPMENT OF TAIWAN

In the past four decades, Taiwan went from an agricultural economy to an industrialized one. Since 1952, annual economic growth rates have ranged from 6 to 10 percent (Goldstein 1997, 25). In 1952 agriculture made up 32 percent of Taiwan's GDP and 95 percent of its exports. In 1996, agriculture was less than 4 percent of GDP and less than 5 percent of exports. In 1952, industrial production was approximately 20 percent of GDP and 5 percent of exports. By 1996 it was 36 percent of GDP and over 95 percent of total exports (Goldstein 1997, 25).

A. LAND REDISTRIBUTION

Taiwan's drastic shift is characterized by four phases. The first phase, which lasted from approximately 1948-1950, was characterized by land redistribution. During this period, farm rents were fixed; credit was made available to buyers; and sellers were compensated with bonds or shares in public enterprises (Feldman 1988, 53). As a result of the land reforms, between 1952 to 1960, product growth in agriculture grew 15.4 percent per year (Feldman 1988, 54).

B. IMPORT SUBSTITUION

The second phase centered on a policy of import substitution and lasted from the early 1950's through to 1962. Import substitution is designed to protect infant industries until they are ready to stand on their own to face world competition. The textile and plastics/synthetic fiber industries are of particular interest during this period. Both of these industries were given preferential treatment by the government. "In textiles, Taiwan imported large amounts of raw materials, which meant that tariffs on imports for these items needed to be reduced if the textile industry was going to succeed in international markets" (Maguire 1998, 52). In addition, imports of yarn and finished products were restricted along with limits on the entry of new producers to prevent excessive competition. Supply response was dramatic. Cotton yarn production increased by 200 percent between 1951 and 1954. As the textile supply skyrocketed, price-cutting wars soon followed that resulted in many firms going bankrupt and others shifting into exports. Between 1958 and 1959, textile exports increased by 200 percent (Wade 1992, 79).

The textile industry received another boost in 1954 when the chemical industry developed to the point that it could provide the intermediate inputs needed to make rayon.

The government decided to build a rayon plant as a way to diversify the textiles industry away from cotton fiber. The government brought together an American synthetic fiber company, von Kohorn, with local textilers to form a joint textiles venture. The U.S. company provided the planning, installation of equipment, and worker training necessary to begin manufacturing. The resulting company became the largest public firm on the island, although the government retained a strong influence over operations. Other examples of government restrictions in the textiles industry include concessional credit and threats of import liberalization for substandard quality (Wade 1992, 80). Similar to the synthetic fiber industry, the plastics industry began in 1953 again under government operation. Taiwan's chief economic planner identified plastics as a suitable target industry and searched for a private investor to take the reigns. In 1957, the first operational plastics plant in Taiwan was turned over to private hands.

C. EXTERNAL ORIENTATION

The third phase focused on external orientation and lasted from 1962-1980. Due to the protection afforded to firms in the earlier development phases, the supply generated by these firms outstripped domestic demand. This

surplus of domestic industries was a driving force in bringing about Taiwan's third economic phase. As Wade (1992, 87) points out, the market orientation change was a response to market forces and not an anticipation of those changes. This is consistent with the self-regulation market theory of Taiwan's success. However, for industries to prosper in international markets meant that government needed to make changes in its foreign exchange and trade policy. Trade policy reform reduced tariffs to 35 percent and also established export-processing zones (EPZ). These zones were designed to have minimum regulations so long as firms operating within them exported all of the products they produced. This stipulation was designed to ensure domestic producers were not adversely affected by decreased regulation. This set-up was especially attractive to multinational corporations looking for a lower-wage labor location. As a result, Taiwan experienced an influx of these corporations during this period. Throughout the 70's and 80's EPZ's accounted for almost 10 percent of total exports (Maguire 1998, 53).

Most of the industries of interest (textiles, plastics, and electronics) also underwent changes during this phase. The earlier government process of constructing joint ventures between foreign investors and private firms carried

over into the third phase. The earlier successes helped convince other potential foreign investors that the government would stand by its agreements with foreign companies. In 1962, the same state-sponsored rayon company mentioned earlier created another company to produce nylon. Following this growing trend, by 1977 there were 28 companies making synthetic fibers. Through it all, the government remained active, particularly by helping private domestic firms find foreign firms willing to share their technology. By 1991, Taiwan was the fourth largest synthetic fiber producer in the world (Wade 1992, 91). The plastics industry generally progressed along a similar course during this phase. To gain access to foreign technology, Taiwanese firms had to rely on joint ventures and licensing agreements. As was true for the first plastics plant turned over to private industry, state-owned industries that were already operational continued to enter into joint ventures with private foreign companies.

By 1968 electronics was the second largest exporting industry behind textiles. By 1984 it was the largest exporting industry. Taiwan's electronics industry began in the 1960's when U.S. firms began looking at opportunities for relocating production to inexpensive labor sites. The objective was to cut costs by producing the labor-intensive

parts of products abroad for less than could be done at home. After the first company located in Taiwan, the government began to actively seek out U.S. companies to locate in country. General Instruments was the first U.S. company to begin production in Taiwan in 1964 (Wade 1992, 94). In 1966 the government issued a plan to turn Taiwan into an "electronics industry center." The government then formed an electronics group to assist in marketing, coordinating with foreign demands, raw material procurement, and training personnel.

D. HIGH-TECHNOLOGY EXPORT ORIENTATION

The fourth phase again focused on export orientation and began in the mid 1980's. To deal with rising labor costs, legislation was passed that allowed capital to be invested abroad. This legislation, combined with allowing travel to mainland China, resulted in the flight of many labor intensive industries such as plastics, footwear, apparel, and toys out of the country in search of cheaper labor on the mainland. In addition, many small companies moved their production lines and managers abroad. To compensate for the exodus of jobs, Taiwan moved aggressively into more sophisticated and profitable high-technology production. Taiwan first focused on the electronics

industry and later specifically on computer related products.

Taiwan's trade policy during this period also moved toward electronics industry protection. In a previous study, Dahlman (1990) rates Taiwan's trade protection as high relative to other countries in the electronics industry. Imports of Consumer Electronics were restricted to 35% in 1986 while restrictions on Parts and Components were as high as 50%. Due to the small size of Taiwanese firms, they do not benefit from organizational economies of scale like Korean conglomerates in the purchase of inputs, international marketing, or cross-subsidization of R&D. As a result they relied heavily on public R&D organizations and subcontracting with foreign firms for technology transfers. The government also identified particular items in the industry and targeted them with fiscal investment incentives and concessional credit to promote production. In addition, the government set up a specific fund to encourage joint development of new products between private firms and public labs. This was how the Data Storage and Processing sector was promoted during this period. By the end of 1996, Taiwan had become the third largest information products manufacturer in the world behind the US and Japan. In summary, the historical evidence shows that many of the

exporting firms have better access to inputs than their counterparts in the domestic market. The question to be addressed is how efficiently are these inputs used?

In 1991, the year on which this study is based, the electronics industry had a total of 3989 firms and was composed of four four-digit Standard Industrial Classification (SIC) products; Data Storage and Processing Units (3621), Consumer Electronics (3622), Parts and Components (3623) and Communication Equipment (3624). Table 1 shows the number of firms in each four-digit product as well as the proportions of the firms that only export, only produce domestically, or sell in both markets. Table 1 also shows the proportion of total industry sales and employment for each product.

Table 1: Firms in the electronics industry by market orientation

	Number of Firms	Proportion in Export Only	Proportion in Both	Proportion in Domestic Only	Proportion of Total Sales	Proportion of Total Employment
Data Storage	107	0.10	0.55	0.35	0.17	0.12
Consumer Electronics	1302	0.12	0.33	0.55	0.36	0.32
Parts & Components	333	0.11	0.30	0.59	0.09	0.08
Communication Equipment	2247	0.05	0.25	0.70	0.38	0.48

In Table 1, we see that 8 percent of all firms and less than 10 percent of total industry sales came from the Parts & Components product. This is a large change from five years earlier when 59 percent of all firms in the electronics industry were producing in this product group. The difference arises due to the shift in firms from Parts and Components in 1986 to Communication Equipment in 1991. In 1986, only 7 percent of all electronics firms were engaged in the Communication Equipment product-code, but by 1991, this product group accounted for 57 percent of the total firms in the electronics industry. However, as in 1986, 70 percent of the firms in the largest four-digit product (Communication Equipment) only sell in the domestic market. On the other hand, 65 percent of the firms in the smallest product group (according to number of firms), Data Storage, export either some or all of their output (Aw and Hwang 1995).

For the remaining three industries (textiles, apparel, plastics) we did not examine every four-digit product in the industry. Instead we chose representative four-digit products based on their share of total industry sales. In each industry we examined a small number of four-digit products that accounted for the bulk of total industry output. These product groups were selected (based on their

share of industry output) as representative groups for the entire industry. Table 2 shows the four-digit items chosen and their proportions of total industry sales and employment.

Table 2: Product Proportion of Total Market

Product	Sales	Employment
Cotton Textiles (1310)	0.24	0.22
Knitting Mills (1342)	0.10	0.15
Synthetic Textiles (1360)	0.37	0.27
Other Textiles (1390)	0.08	0.13
Top Four Textile Total	0.79	0.77
Apparel (2301)	0.80	0.82
Plastic Pipes & Sheets (3101)	0.37	0.20
Plastic Housewares (3103)	0.09	0.13
Other Plastics (3109)	0.29	0.34
Top Three Plastics Total	0.75	0.67

Table 2 confirms that in all three industries, only a few four-digit groups in each industry comprise at least 75 percent of total industry sales and over 65 percent of total industry employment. In the textiles industry for example, of the eleven four-digit items, only 2 [Cotton (1310) and Synthetic (1360)] account for 61 percent of total textile sales. In the apparel industry, the 2301 product-code alone

contributes 80 percent to sales and as a result was the only category examined in that industry. The 2301 category consists of articles of clothing that have similar inputs and methods of production (such as pants and shorts or shirts and sweaters for example). For our analysis, this level of aggregation is reasonable.

Table 3 reports the number of firms in each of the four-digit products examined according to industry. In addition, the table also displays the proportions of these firms that sell only in the domestic or export market as well as the proportion of total firms that sell in both (by industry).

Table 3: Firms by Market-Orientation and Industry

Four-digit Product	Number of Firms	Proportion in Export Only	Proportion in Both	Proportion in Domestic Only
Cotton Textiles (1310)	605	0.03	0.12	0.85
Knitting Mill Textiles (1342)	526	0.24	0.26	0.50
Synthetic Textiles (1360)	640	0.03	0.26	0.71
Other Textiles (1390)	1165	0.05	0.12	0.83
Textiles Total	2936			
Apparel (2301)	1736	0.16	0.12	0.72
Plastic Pipes & Sheets (3101)	989	0.03	0.18	0.79
Plastic Housewares (3103)	1981	0.03	0.07	0.90
Other Plastics (3109)	4153	0.04	0.11	0.85
Plastics Total	7123			

The three industries above show similar characteristics to the electronics industry. In the largest four-digit product group in each industry (according to number of firms) the majority of firms sell their output only domestically. For example, in the plastics industry, 85 percent of firms in the Other Plastics product category sell exclusively in the domestic market. On the other hand, the proportion of firms that sell in the export market is highest for the smallest product group (by number of firms). For instance, the Knitting Mills (1342) group is the smallest in the textiles industry but 50 percent of the firms sell part or all of their output in the export market.

E. PRODUCT MIX COMPARISON

To address the possibility that output differences could be the result of exporters belonging to a certain product group we need to compare the product mix between exporters and non-exporters. One way to accomplish this is to separate each industry into two groups, one for exporters and another for domestic producers. After this separation, the proportion of domestic and export-oriented firms in each product category should be roughly equivalent. If they are not, then the output difference between groups could be from exporters producing products that have higher output levels.

Following the reasoning above, a breakdown of the data set by industry and then by four-digit product group provides a method to determine if product composition is a factor in the analysis. For each industry examined the exporters and domestic producers were separated into their respective groups. From these groups the proportion of export and domestic firms producing in each four-digit product were calculated. If the proportion of exporters and non-exporters in a specific product group are not similar, it is possible that exporters are concentrated in a certain product where output is higher than average. A larger share of exporters in this product could be a possible explanation for the larger average output levels observed in exporters. Table 4 contains the relevant information at the lowest level of disaggregation for which we have data.

Table 4: Product mixes of domestic and export firms

	Share of Total Firms			Share of Total Firms	
Electronics Four-digit Product	Domestic	Exporters	Textiles Four-digit Product	Domestic	Exporters
Data Storage	0.02	0.06	Cotton (1310)	0.23	0.10
Consumer Electronics	0.29	0.45	Knitting Mills (1342)	0.12	0.41
Parts & Components	0.08	0.09	Synthetic (1360)	0.22	0.20
Communication Equipment	0.61	0.40	Other (1390)	0.43	0.28
Plastics Four-digit Product	Domestic	Exporters	Apparel Four-digit Product	Domestic	Exporters
Pipes & Sheets (3101)	0.13	0.18			
Housewares (3103)	0.29	0.21	2301	0.69	0.77
Other (3109)	0.58	0.62			

From Table 4, we note that in the electronics industry the product composition between exporters and non-exporters is approximately the same. The majority of firms in both the domestic (90%) and export (85%) markets produce in either the Consumer Electronics or Communication Equipment groups. The same pattern also holds true for the plastics and apparel industries. In plastics, most of the firms in either market produce in the Other Plastics product group (Domestic - 58%, Exporters - 62%). The remaining firms are roughly evenly distributed between the other two product

categories. The apparel industry is unique in that, as mentioned earlier, the majority of firms are concentrated in a single product group. Therefore, the figures reported in Table 4 represent total industry proportions. For example, 69 percent of total domestic apparel producers are in the 2301 product category. However, the numbers still provide evidence that domestic-oriented firms and exporters have roughly the same product mix.

On the other hand, the textile industry does show some degree of product differences between exporters and domestic producers. The difference arises in the Other (1390) and Knitting Mill (1342) textile product groups. 41% of exporting firms produce in the Knitting Mill category compared to only 12% on the domestic side. Likewise, 43% of all domestic firms in the textiles industry produce in the Other Textiles product group compared to 28% of the exporting firms. Although this difference is not extremely large, it is possible that product composition could be contributing to the differences in output between domestic producers and exporters in the textile industry. Excluding the textiles industry, the data generally supports the fact that there are no large product differences between producers that sell either in the domestic or export market.

Table 5 reports the average firm characteristics for the four industries based on market orientation. By any measure of size (total sales, value-added, or employment), exporters are much larger than non-exporters. This is consistent with the findings of Aw and Hwang (1995) in their similar study of Taiwan in 1986. In the textiles industry for example, exporters on average employ over 50,000 more workers than domestic producers. Exporting firms also have a larger capital-labor ratio in all industries except for apparel. The capital-labor ratio is measured as the value of net assets per worker. However, there does not seem to be the expected positive relationship between the capital-labor ratios and the value-added-labor ratios in the textiles or apparel industries. This result is unsettling due to the usual fact that more capital-intensive firms usually have larger value-added-worker ratios. Nevertheless, the most important size characteristic concerning this paper is the difference in average value-added due to market orientation. We see that in the electronics industry exporters on average have over 6.5 times more value-added than non-exporters. This differential in value-added is precisely what this paper addresses.

Table 5: Mean characteristics of firms by market orientation

	Electronics Industry		Plastics Industry		Apparel Industry		Textiles Industry	
Variable	Domestic	Export	Domestic	Export	Domestic	Export	Domestic	Export
Sales ('000 NT$)	54,042.4	457,970.6	4,127.7	123,316.3	16,938.4	97,851.1	35,843.6	126,812.9
Value-Added ('000 NT$)	22,345.2	151,281.7	6,699.8	70,106.2	7,429.7	43,593.1	14,045.4	59,222.7
Employment (Number)	35.1	175.5	12.9	69.5	20.5	86.1	2,311.6	57,142.4
Capital-Labor Ratio ('000 NT$ per worker)	1,482.6	2,056.4	1,556.8	1,771.2	1,329.8	1,170.3	1,630.8	2,027.1
Value-Added-Labor Ratio ('000 NT$ per worker)	437.9	925.5	444.3	617.4	390.1	536.3	318.4	303.1

In summary, a large portion of each industry's output comes from a small number of four-digit items. Also, the largest sectors (in terms of number of firms) in each industry have the largest percentage of firms that sell only domestically, while the opposite holds true for the smallest product group having the largest percentage of exporters. Although the textiles industry shows some evidence of product mix differences by market-orientation, for the most part there are no large differences between exporters and non-exporters. Finally, exporting firms tend on average to

have much higher value-added and are more capital intensive than domestic firms.

III. EMPIRICAL MODEL

The model used to measure productivity follows closely Aw and Hwang (1995) in 1986. However, instead of just the electronics industry, we apply the same empirical model to the textiles, apparel, and plastics industries for 1991.

A. TRANSLOG PRODUCTION FUNCTION

The model begins with the estimation of a separate production function for domestic and export firms in each four-digit product. The functional form for the production function is the translog production function developed by Christensen et al. (1971, 1973). The translog form is more general than the typical Cobb-Douglas production function because it does not make any restraints on homogeneity, homotheticity, or elasticities of substitution. The coefficients estimated are the output elasticities with respect to the inputs. Since the parameters represent the percentage change in output for a percentage change in input, a larger estimate equates to more efficient use of the input. The intercept term represents exogenous productivity-enhancing factors. Thus, we interpret the parameter estimates as our measure of productivity.

The estimates in each market (domestic/export) are then used to measure the productivity differences due to market

orientation. That is, we use these parameters to distinguish between the contribution of productivity and input differences to output differences between exporters and domestic-oriented firms.

The production function estimated for each group is given by:

$$\ln Q = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 (\ln L)^2 + \beta_4 (\ln K)^2 + \beta_5 \ln L \ln K + \eta$$

Where Q represents value-added, L is the number of employees, K is measured as the book value of the firm, and η is a random error term.

Value-added is measured as the difference between the value of output and the total expenditure on intermediate inputs (Aw and Hwang 1995). We use total sales as a proxy for the total value of output because information on firm inventory levels is unavailable. Using total sales assumes that positive or negative inventory changes will not significantly skew the value-added measure. Value-added is calculated as:

$$\mathbf{Q = Y - (M + E + X)}$$

where **Y** represents total sales, **M** is expenditures on materials, **E** is expenditures on energy, **X** is expenditures on electricity.

B. LABOR DEMAND EQUATION

From the production function we derived the profit-maximizing input demand equations. Making the assumption that firms are price takers in both the input and output markets, the output elasticities with respect to each input must equal the factor share for that input. For labor output elasticity this results in the following:

$$\partial \ln Q \big/ \partial \ln L = P_w L \big/ P_q Q = \beta_1 + 2\beta_3 \ln L \quad \beta_5 \ln K + \varepsilon$$

Where $\partial \ln Q \big/ \partial \ln L$ is output elasticity of labor, P_w is the labor wage, L is labor, P_q is the price of the output, ε is a random error term, and the β's are the same parameters as in the production function.

Due to multicollinearity between the independent variables it is difficult to obtain accurate parameter estimates for the translog production function. To correct for this problem we can estimate the labor demand equation in conjunction with the production function to take advantage of the cross equation restrictions. This increases the precision of our parameters by lowering the standard deviations of our estimates. As a result, the labor demand equation above, along with the production

function, form the basis for the regression system. A separate regression was performed on each set of exporters and non-exporters within each four-digit product code. Running separate regressions allows the coefficients for the two groups to be different. The two equations were estimated simultaneously using Zellner's seemingly unrelated regression estimator. This method allows for joint estimation and for the error terms associated with the dependent variables to be related. This estimator may lead to more efficient estimates than if the regression was performed using regular ordinary least squares.

C. VALUE-ADDED DECOMPOSITION

After the parameters are estimated for the two groups in each product category they can then be used to determine the amount of value-added difference that can be explained by productivity or input level differences. As in Aw and Hwang (1995), I used the framework based on a wage discrimination study by Blinder (1973). In a similar empirical manner, I broke the value-added differences between domestic firms and exporters into productivity differences and size differences.

Since the parameter estimates represent the gauge for productivity, the difference between the estimates for

exporters and non-exporters provides the measure of productivity differences. Similarly, differences between average input resources can be used as a proxy for input level differences between exporters and non-exporters. Since product specific reasons for output differences have already been addressed, the model determines the individual contributions of productivity and input levels to output differences.

Estimating separate production functions for each group and letting the superscripts D and E represent domestic-oriented and export-oriented respectively yields the following set of regression equations for each four-digit product:

$$\ln Q^D = \beta_0^D + \beta_1^D \ln L^D + \beta_2^D \ln K^D + \beta_3^D (\ln L^D)^2 + \beta_4^D (\ln K^D)^2 + \beta_5^D \ln K^D \ln L^D + \eta^D$$

$$\ln Q^E = \beta_0^E + \beta_1^E \ln L^E + \beta_2^E \ln K^E + \beta_3^E (\ln L^E)^2 + \beta_4^E (\ln K^E)^2 + \beta_5^E \ln K^E \ln L^E + \eta^E$$

Once the parameters are estimated (letting b^E and b^D represent the estimated coefficients for the export and domestic-oriented firms respectively) the average difference in value-added between exporters and non-exporters can be represented by equations (1) - (4):

$$(1)\quad \overline{\ln VA^{E}} - \overline{\ln VA^{D}} = b_{L}^{E} \cdot (\overline{\ln L^{E}} - \overline{\ln L^{D}}) + b_{K}^{E} \cdot (\overline{\ln K^{E}} - \overline{\ln K^{D}}) + b_{sqL}^{E} \cdot (\overline{sq\ln L^{E}} - \overline{sq\ln L^{D}}) +$$

$$(2)\quad + b_{sqK}^{E} \cdot (\overline{sq\ln K^{E}} - \overline{sq\ln K^{D}}) + b_{LK}^{E} \cdot (\overline{\ln L \ln K^{E}} - \overline{\ln L \ln K^{D}}) +$$

$$(3)\quad + (b_{I}^{E} - b_{I}^{D}) + (b_{L}^{E} - b_{L}^{D}) \cdot \overline{\ln L^{D}} + (b_{K}^{E} - b_{K}^{D}) \cdot \overline{\ln K^{D}} + (b_{sqL}^{E} - b_{sqL}^{D}) \cdot \overline{sq\ln L^{D}}$$

$$(4)\quad + (b_{sqK}^{E} - b_{sqK}^{D}) \cdot \overline{sq\ln K^{D}} + (b_{\ln L\ln K}^{E} - b_{\ln L\ln K}^{D}) \cdot \overline{\ln L \ln K^{D}}$$

These equations decompose the average difference in value-added between exporters and domestic producers into two components. The right-hand-side (RHS) terms in lines 1 and 2 are mean differences in inputs weighted by their respective coefficient for the export firms. For example, the first term on the RHS in line one is the exporter estimated labor coefficient multiplied by the difference between exporter and non-exporter average labor per firm. The RHS terms in lines (1) and (2) represent the portion of value-added differential that is due to input level differences. The right-hand terms in lines (3) and (4) are the differences in coefficients between exporters and non-exporters weighted by the respective mean of non-exporters. For example, the second term in line three is the difference between the exporter and non-exporter estimated labor coefficients multiplied by the average natural log of labor for the domestic firms. Lines (3) and (4) measure the

contribution of productivity differences (as measured by differences in the estimated coefficients) to value-added differences.

In the above specification, the average input differences are weighted by the exporter's estimated coefficients and the domestic average input levels weight the coefficient differences. However, the weights could have easily been reversed so that domestic coefficients served as weights on the mean inputs and exporter average inputs were used as weights for the coefficient differences. The decision of which weighting scheme to use is an indexing problem. Following the convention of previous studies I used both sets of weights to compute a range of the value-added effects of productivity differences.

It is important to remember that the model previously specified is designed to separate the effects of input level differences from productivity differences to explain the differences in mean value-added between export-oriented and domestic-oriented firms. The model cannot say anything about how these productivity differences originated. In addition, it is not possible to determine whether firms that are in the export industry became more productive after they entered (perhaps due to increased market competition), or

whether the more productive domestic firms were self-selected into the export market.

IV. DATA

In 1991, The Department of Statistics in Taiwan conducted a census of manufacturing on more than 100,000 establishments. This paper focuses on 4 (electronics, textiles, apparel, plastics) of the two-digit Standard Industrial Classification (SIC) industries in the data base. The data set contains firm-level information on the following variables; total value of sales (broken down by domestic and export sales); total value of net assets; number of production and nonproduction workers; expenditures on raw materials, energy, and electricity; and the total value of subcontracting income. The unique market orientation feature of total sales is what allows us to analyze exporters and domestic-oriented firms separately.

A. DATA SET CLEANING

Before the analysis of the four industries could be conducted, the data set needed to be examined for any inconsistencies that the model was not designed to handle. Taiwan has an extensive subcontracting industry with some unique characteristics that may cause problems for the model if not taken into account. First, firms that are pure subcontractors report zero sales. Second, subcontractors do not incur the cost of materials used in production, since

the subcontractee pays for these costs. As a result, any firms that listed subcontracting sales as greater than 50 percent were deleted from the data set.

Since the model is specified entirely in natural logarithms and because the natural logarithm function is undefined for negative and zero values, the variables used in the regression cannot take on these values. Therefore, any firms that reported negative or zero values for the variables under consideration were dropped from the data set. Table 6 shows the results of the cleaning process:

Table 6: Percentage of Total Firms Eliminated in Filtering

INDUSTRY	Initial # of Firms	No Sales	Subcontracting Share > 50%	Zero or Negative Values
Textiles	7690	41.9%	1.5%	0.3%
Plastics	13018	22.7%	0.3%	0.4%
Electronics Industry	6631	38.5%	0.9%	0.4%
Apparel	3588	33.7%	1.2%	0.1%

We see from Table 6 that the majority of firms deleted were those that had no sales. As mentioned earlier, these firms are pure subcontractors. As a result, the percentage of firms deleted for having a subcontracting share of total sales greater than 50 percent is small because most were eliminated by the "no sales" criteria.

B. VARIABLE SPECIFICATION

From the remaining data set production functions were estimated for exporters and non-exporters in each industry. As mentioned earlier, value-added was calculated as the value of total sales minus the value of intermediate inputs. Labor was measured as the total number of employees regardless of staff positions or self-employed status. The value of net assets was used as a proxy for capital. However, Aw and Hwang (1995) point out that using such a measure of capital ignores the different rates of capital utilization between firms. Other work by Abbott (1988) concludes that capacity utilization is an important factor when estimating production functions. However, because the data set does not include the capacity utilization rate using "the value of assets" for the capital measure was unavoidable. Following the procedure in Aw and Hwang (1995), exporters were classified as firms whose export share of total sales was greater than 25 percent. The following table presents the proportion of firms that exported which were excluded from the export group.

Table 7: Percentage of Exporters Excluded

Electronics Four-Digit Product	% of Exporters Excluded	Textiles Four-Digit Product	% of Exporters Excluded
Data Storage	10%	Cotton Textiles	13%
Consumer Electronics	12%	Knitting Mills	8%
Parts & Components	21%	Synthetic Textiles	18%
Communication Equipment	22%	Other Textiles	17
Plastics Four-Digit Product	**% of Exporters Excluded**	**Apparel Four-Digit Product**	**% of Exporters Excluded**
Plastic Pipes & Sheets	28%		
Plastic Housewares	27%	2301	5%
Other Plastics	26%		

From Table 7 it is clear that in most four-digit codes, only a small portion (usually less than 25 percent) of firms that export were not included in the export group. For example, in the electronics industry roughly 20 percent of all firms that exported in Parts and Components and Communication Equipment were excluded from the export group. Aw and Hwang (1995) find that as the cutoff for the definition of exporters increases, the productivity differences between exporting and domestic-oriented firms rises. In light of this, even the large percentage of exporters excluded in the plastics industry will not greatly affect the analysis.

V. EMPIRICAL RESULTS

Appendix A presents the results of the joint regressions by industry. The industries are broken down into their four-digit products to control for differences in product mix. Separate regressions were performed for exporters and non-exporters. From Appendix A we see that in general the labor coefficient estimates are reasonable and significantly different from zero. However, the capital estimates, while still reasonable, are rarely significantly different from zero. This might be the result of not having a measure of capital that accounts for the capacity utilization of the firm. This could also be an explanation for the insignificant intercept terms. If the capital variable is not a good measure for the capital used in production, then it is possible for this to influence the centering of the regression represented by the intercept.

A. CHOW TEST

Productivity in this model is captured in the estimated parameters and intercept term. If exporters are more productive, than they should on average have larger coefficients or intercept terms. However, before we can examine the differences between the parameters we must first ensure that the coefficients are statistically different

from one another. If they are not, than the output differences between exporters and non-exporters will be entirely explained by input differences since the two groups statistically have the same measure of productivity. The Chow Test is used to test the hypothesis that the estimated coefficients of the regressions for exporters and non-exporters are equal. The formula for computing the F statistic is:

$$\text{F statistic} = \frac{\dfrac{RSS^C - (RSS^1 + RSS^2)}{K}}{\dfrac{(RSS^1 + RSS^2)}{N^1 + N^2 - 2K}}$$

Where $\mathbf{RSS^C}$ = Error sum of squares from the pooled (combined) regression, $\mathbf{RSS^1}$ and $\mathbf{RSS^2}$ are the error sum of squares from the domestic and exporter regressions, $\mathbf{N^1}$ and $\mathbf{N^2}$ are the number of observations for each estimation, and $\mathbf{K}$ is the number of parameters estimated.

The critical F statistic = $F(K, N^1+N^2-2K)$ and at the 5% level is approximately 2.1. The computed F statistics for all the four-digit codes are reported in Table 8.

Table 8: Chow test for exporter/non-exporter coefficients

	Electronics Industry			
	Data Storage Processing Units	Consumer Products	Parts and Components	Communication Equipment
Computed F-Statistic	0.8250	7.5232	2.4715	4.0388
	Apparel Industry	**Plastics Industry**		
	Product 2301	Pipes & Sheets (3101)	Housewares (3103)	Other (3109)
Computed F-Statistic	9.1044	6.3318	1.0295	8.5829
	Textiles Industry			
	Cotton (1310)	Knitting Mills (1342)	Synthetic (1360)	Other (1390)
Computed F-Statistic	0.8104	1.8113	3.7136	5.6556

From Table 8 we see that of the twelve products examined, we fail to reject the hypothesis that the coefficients between exporting and domestic-oriented firms are equal in four products (Data Storage & Processing Units, Cotton Textiles, Knitting Mills, and Other Plastics). On the other hand we reject the hypothesis that the coefficients are equal for exporters and non-exporters in the other eight product groups. The magnitude of the F-statistic may reflect the degree of heterogeneity even within the same four-digit industry code.

B. PRODUCTIVITY CONTRIBUTION TO VALUE-ADDED

The parameter estimates of the production functions reported in Appendix A are used to calculate the percentage of value-added difference between exporters and non-exporters that is attributable to productivity differences. The results are reported in Table 9 on the following page. The table is broken down into two parts by the two weighting systems discussed earlier in Part III. Recall that the initial weighting scheme uses the exporter's coefficients for the average input level weights and domestic input averages for the differenced coefficient weights. The columns labeled "Inputs" represent the sum of weighted input level differences for each respective weighting system. The columns labeled "Productivity" are the sum of the coefficient differences between exporters and domestic-oriented firms. The columns labeled "Productivity Contribution to VA Difference" denote the percentage of value-added difference between exporters and domestic producers that productivity differences explain (by weighting system). The final column labeled "Average Productivity Contribution to VA Difference" is the simple average of productivity contribution as measured by each weighting index.

Table 9: Productivity Contribution by Two Alternative Weighting Systems

	Initial Weighting System			Alternate Weighting System			
Four-Digit Product	Input	Productivity	Productivity Contribution to VA Difference	Inputs	Productivity	Productivity Contribution to VA Difference	Average Productivity Contribution to VA Difference
Consumer Products	1.474	0.201	12%	1.591	0.124	7%	10%
Parts and Components	1.424	0.226	14%	1.310	0.151	10%	12%
Communication Equipment	1.628	0.116	7%	1.790	0.046	3%	5%
Synthetic Textiles	1.896	0.179	9%	1.855	0.219	11%	10%
Other Textiles	1.262	0.275	18%	1.317	0.219	14%	16%
Apparel 2301	1.292	0.263	17%	1.361	0.193	12%	15%
Plastic Pipes & Sheets	1.457	0.283	16%	1.498	0.242	14%	15%
Other Plastics	1.121	0.168	13%	1.172	0.117	9%	11%

C. ELECTRONICS INDUSTRY

Tables 8 and 9 provide the necessary information to draw conclusions about each industry. In the electronics industry, we fail to reject the hypothesis that exporters and non-exporters have equal coefficients for the Data Storage and Processing Units category. Aw and Hwang (1995) also reached the same results for the Chow Test using the 1986 data. They cited that young firms operating in a highly competitive market characterized this four-digit

product code. A firm's market orientation in this product group does not play a significant role in productivity because there is little protection from imports or exports. Aw and Hwang (1995) also state that government policy no doubt contributed to lessening the gap between domestic and exporting firms in this industry. In the early 1980's the government facilitated contact between private firms and public research undoubtedly decreased the differences between exporters and non-exporters.

The remaining three electronics products all reject the hypothesis that exporter and non-exporter coefficients are equal. From Table 9 the average productivity contribution to value-added difference ranges from 5 percent in the Communications Equipment product to 12 percent in the Parts and Components category. It is interesting that in Aw and Hwang (1995), the Communications Equipment product had a productivity contribution of 19.5 percent while in this study it has the lowest contribution at 5 percent. The tremendous growth in the number of firms in this industry may explain why the productivity component decreased so substantially. The increased competition caused by the entry of so many firms forced the domestic producers to become more productive to remain in operation. As domestic producer productivity increased to remain in operation, the

differences in value-added between exporters and domestic-oriented firms are explained more by resource differences than by productivity ones.

In the Consumer Electronics product group, the higher productivity among exporters appears to be due to more efficient use of inputs. This is consistent with the results found by Aw and Hwang (1995) in the 1986 study. The higher productivity for exporters in both Consumer Electronics and Parts & Components groups is explained by the liberal use of trade restrictions in these product categories (Dahlman 1990). The productivity contributions in these electronics products (Consumer Electronics and Parts and Components) are also slightly higher than in the 1986 study. This would tend to indicate that exporters are widening the productivity gap between domestic and exporting firms. As noted earlier, however, the causality behind the widening gap is not addressed in this model.

D. TEXTILES INDUSTRY

In the textiles industry we fail to reject the hypothesis that the coefficients for exporters and domestic-oriented firms are equal for the Cotton and Knitting Mill products. As noted before, in the second phase of Taiwan's recent economic development, the supply of cotton textiles exploded during the 50's. The resulting price-cutting wars created a highly competitive market. In the third phase (1960-1980) trade de-regulation lessened the domestic protection afforded to these industries since they had become fairly mature. As a result, the Chow Test shows that there is no significant difference between exporter and non-exporter coefficients.

On the other hand, protection was still afforded to domestic synthetic textile firms through government regulation and the use of EPZ's. The continuing government protection may explain why it is reasonable that we reject the hypothesis that the coefficients are equal for exporters and non-exporters in these categories. In the Synthetic Textiles product group differences in productivity contribute 9%-11% of the difference in value-added between exporters and non-exporters while the corresponding magnitude for the Other Textiles group (1390) was 14%-18%. As mentioned earlier, trade protection for these four-digit

products helps explain the higher productivity for exporters relative to domestic-oriented firms.

E. PLASTICS INDUSTRY

In the plastics industry, we fail to reject the hypothesis that the coefficients for exporters and non-exporters in the Plastic Housewares product group are equal. This can partially be explained by the market orientation of firms in this category. In this product group 97% of the 1,981 total firms sell in the domestic market. The large number of domestic producers as compared to exporters may be a reflection of the high level of domestic competition in this product. As a result, domestic-oriented firms and export firms do not have significantly different coefficients. For the remaining two products (Plastic Sheets & Pipes and Other Plastics), productivity contributions range from 9% to 16%. The difference in value-added can partly be explained by the close connection between the government, public firms, and foreign companies. The foreign companies that participate in joint ventures with public firms are closely monitored by the government and are often limited to operation only within EPZ's. This way domestic plastic firms are protected from the joint venture firms who benefit from technology transfers or

access to foreign capital. As a result, the value-added differential is partially explained by exporters being more productive.

F. APPAREL INDUSTRY

In the apparel industry (represented by the 2301 product group), 12%-17% of the value-added difference is due to productivity differences between domestic and export-oriented firms. This means that domestic producers are not as efficient in their input usage as export-oriented firms. As noted earlier however, the model cannot test causality.

G. SUMMARY

Overall, productivity differences between exporters and non-exporters contribute significantly to their value-added differences, but the magnitude is product specific. In the product groups where exporters and non-exporters showed significantly different coefficients, the percentage differences in value-added explained by differences in productivity do not appear to be large. However, even a 5 percent increase in production due to productivity over several million dollars becomes a substantial amount.

While most of the discussion explaining productivity differences focused on trade policy, it is important to

mention other sources that were not examined in this paper. First, if exporters are more productive than non-exporters, given their easy access to new and better technology from foreign buyers, it is still possible that there are insignificant differences in observed productivity if the technology is quickly transferred from exporters to domestic firms. Another explanation for the productivity differences between exporters and non-exporters deals with self-selection. Aw et al. (1999) show that domestic firms that enter into the export market have higher productivity prior to entry than firms that choose not to enter. In addition, firms that exit the export market are less productive than firms that continue in the industry. These self-selection patterns also help explain the productivity differences between exporters and non-exporters.

VI. SUMMARY AND CONCLUSIONS

This paper decomposes the differences in value-added between domestic-oriented and export-oriented firms into two components. After controlling for product specific effects on output, we show that the observed value-added differences between exporters and non-exporters can arise from input level differences or productivity differences. Input differences arise from the fact that exporters on average are much larger than domestic firms. It could be that they are larger because they have better access to inputs due to foreign contacts and government support. Alternatively, exporters may face a downward sloping domestic demand and can grow by entering the larger world market. Also, larger firms that are not already exporting might enter the export market because they can absorb the costs of establishing export contacts better than smaller firms can. Productivity differences between exporters and non-exporters are explained by increased competition in the international market. Exporters face more competition compared to their domestic counterparts and are likely to be more efficient in their input use than firms operating in a protected domestic market.

An initial look at the data sheds light on the characteristics common to the industries examined. First, a

large portion of each industry's output comes from a small number of four-digit items. Also, the largest sectors (in terms of number of firms) in the industry have the largest percentage of firms that sell only domestically, while the opposite holds true for the smallest product group which has the largest percentage of exporters. For the most part there are no large differences between the product mix of exporters and non-exporters. Lastly, exporting firms tend on average to have higher value-added and are more capital intensive than domestic firms.

The results from the model provide a measure of the difference in value-added between exporters and domestic-oriented firms that is due to productivity differences between the two groups. The model also shows how much of the value-added differential is due to resource differences. It is important to remember that the model cannot determine if the productivity differences observed are the result of export activity or if the more productive firms self-select into the export market.

This paper shows that although input level differences explain the majority of the value-added differential between exporters and non-exporters, productivity differences do contribute a significant portion towards explaining output differences. The study finds that in several products

exporters have higher levels of productivity than domestic-oriented firms that sell similar products. In all of the products examined, the contribution of productivity differences between exporters and non-exporters ranged from 5% to 16%. To the extent that exporters are more productive because they are in the export market, government policy that directs resources or makes inputs more accessible to export-oriented firms may be justifiable. On the other hand, in those products where domestic firms are just as productive as exporters, then incentives favoring the latter over the former group of producers are unlikely to improve overall productivity.

A closer examination of Taiwan's trade policy with respect to the various products suggests that product groups that are subject to import protection are the ones that are more likely to exhibit productivity differences between domestic and export-oriented firms. In contrast, the categories where there is little protection or fierce domestic competition show no significant difference in productivity. While Taiwan's trade policy seems to be a major factor in its extraordinary growth, we must be careful not to suggest that the same policy will have similar results in another country. Every nation has a distinct set of components such as culture, government, resources, and

geographic location that all play a role in determining policy outcomes. What works for one country may not necessarily work for another. However, the results of this paper do imply that productivity gaps are linked closely with domestic protection. In light of this, governments may want to first examine the effects of their protective trade policy before providing subsidies to any particular group of producers.

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VIII. APPENDIX A

(P-values for parameters are directly below estimates)

Textiles	Cotton Textiles		Knitting Mill Textiles		Synthetic Textiles		Other Textiles	
Independent Variables	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms
Log Labor	0.729	0.515	0.771	0.546	0.581	0.569	0.734	0.594
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log Capital	0.516	0.762	1.128	0.644	0.653	0.881	0.788	0.593
	0.002	0.152	0.001	0.229	0.000	0.001	0.000	0.100
$(\text{Log Labor})^2$	0.108	0.092	0.120	0.090	0.112	0.081	0.126	0.089
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$(\text{log Capital})^2$	0.003	-0.011	-0.032	-0.006	-0.005	-0.008	-0.015	-0.001
	0.754	0.665	0.076	0.828	0.519	0.502	0.065	0.960
(Log Labor)*(Log Capital)	-0.066	-0.046	-0.067	-0.046	-0.055	-0.051	-0.068	-0.051
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	2.300	1.538	-0.589	2.182	1.869	0.254	1.152	2.182
	0.008	0.605	0.702	0.420	0.027	0.868	0.084	0.237
R^2	0.804	0.885	0.772	0.679	0.813	0.902	0.768	0.855
Number of Observations	545	60	286	240	522	118	1004	161

(P-values for parameters are directly below estimates)

Electronics Industry	**Data Storage Processing Units**		**Consumer Products**		**Parts and Components**		**Communication Equipment**	
Independent Variables	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms
Log Labor	0.636	0.291	0.727	0.878	0.653	0.530	0.702	0.503
	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Log Capital	0.996	0.677	0.240	0.458	0.362	0.675	0.364	0.836
	0.231	0.229	0.186	0.070	0.086	0.172	0.002	0.000
$(\text{Log Labor})^2$	0.107	0.045	0.099	0.061	0.083	0.082	0.105	0.076
	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.000
$(\text{log Capital})^2$	-0.024	-0.001	0.018	0.012	0.014	-0.006	0.011	-0.013
	0.516	0.954	0.060	0.377	0.177	0.809	0.060	0.102
(Log Labor)*(Log Capital)	-0.055	-0.022	-0.064	-0.070	-0.051	-0.046	-0.063	-0.040
	0.002	0.027	0.000	0.000	0.000	0.000	0.000	0.000
Constant	0.321	1.922	3.562	2.333	2.631	1.959	3.041	1.042
	0.944	0.570	0.000	0.060	0.016	0.466	0.000	0.296
R^2	0.728	0.845	0.737	0.834	0.853	0.812	0.766	0.846
Number of Observations	44	62	789	513	226	107	1746	501

(P-values for parameters are directly below estimates)

Apparel/Plastics	**Apparel (2301)**		**Plastic Pipes & Sheets**		**Plastic Housewares**		**Other Plastics**	
Independent Variables	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms	Domestic-Market Firms	Export Firms
Log Labor	0.725 0.000	0.690 0.000	0.734 0.000	0.625 0.000	0.650 0.000	0.681 0.000	0.704 0.000	0.689 0.000
Log Capital	0.507 0.003	0.564 0.017	0.266 0.083	1.146 0.000	0.781 0.000	0.386 0.344	0.170 0.058	0.708 0.000
$(\text{Log Labor})^2$	0.112 0.000	0.080 0.000	0.123 0.000	0.101 0.000	0.117 0.000	0.108 0.000	0.121 0.000	0.095 0.000
$(\text{log Capital})^2$	-0.002 0.859	0.002 0.887	0.015 0.067	-0.025 0.042	-0.013 0.142	0.008 0.710	0.022 0.000	-0.003 0.785
(Log Labor)*(Log Capital)	-0.063 0.000	-0.057 0.000	-0.069 0.000	-0.059 0.000	-0.059 0.000	-0.061 0.000	-0.065 0.000	-0.062 0.000
Constant	2.557 0.001	2.194 0.073	3.519 0.000	-0.757 0.584	1.089 0.132	3.145 0.111	3.818 0.000	1.228 0.222
R^2	0.762	0.798	0.768	0.895	0.712	0.858	0.757	0.856
Number of Observations	1271	465	862	127	1830	151	3706	447